

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
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SRM Number: 3113
MSDS Number: 3113
SRM Name: Cobalt Standard Solution

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of cobalt. One unit of SRM 3113 consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of cobalt. The solution contains nitric acid at a volume fraction of approximately 10 %.

Material Name: Cobalt Standard Solution

Other Designations:

Cobalt: Co; elemental cobalt.

Cobalt Nitrate: Cobaltous nitrate; cobalt dinitrate; nitric acid, cobalt salt; cobalt (+2) cation dinitrate.

Nitric Acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10
Cobalt Nitrate	10141-05-6	233-402-1	3.1
Cobalt	7440-48-4	231-158-0	1

EC Classification, R/S Phrases: Refer to Section 15, Regulatory Information.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 4 Fire = 0 Reactivity = 2

Major Health Hazards: Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. Cobalt and its compounds may cause cancer, birth defects, lung damage, and other serious health effects.

Physical Hazards: Glass container may break or shatter.

Potential Health Effects

Inhalation:	Nitric acid can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Teeth may also be damaged. Inhalation of cobalt dust (not present in this SRM) may irritate the respiratory tract and may cause respiratory sensitivity, asthma, or other chronic lung disease or damage. Inhalation of cobalt and its compounds may cause cancer of the lung or other organs, and may also affect the central nervous system.
Skin Contact:	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Skin contact with cobalt or its compounds may cause dermatitis and allergic sensitization.
Eye Contact:	Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Contact with cobalt or water-soluble cobalt compounds may cause eye irritation or corneal damage.
Ingestion:	Nitric acid can cause severe burns and damage to the GI tract. The toxicity of cobalt is low by ingestion, but water-soluble cobalt compounds in large doses may damage the kidneys, liver, or other organs. Repeated exposure to cobalt may have cumulative effects; signs and symptoms may include nausea, vomiting, flushing of the face and ears, low blood pressure, ringing in the ears, reduced thyroid activity, or blood abnormalities. See also Inhalation.

Medical Conditions Aggravated by Exposure: Polycythemia; goiter or other thyroid problems; COPD; any pre-existing disorders affecting the eyes, skin, respiratory tract, GI tract, or other target organs.

Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	<u>X</u>	<u> </u>
In the International Agency for Research on Cancer (IARC) Monographs	<u>X</u>	<u> </u>
By the Occupational Safety and Health Administration (OSHA)	<u> </u>	<u>X</u>

Note: NTP classifies certain cobalt compounds as anticipated human carcinogens. IARC classifies cobalt as a possible human carcinogen.

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. If not breathing, qualified personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minutes, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

Note to Physician (Nitric Acid): Wash affected skin with 5% solution of sodium bicarbonate (NaHCO_2). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Nitric acid and cobalt nitrate are both oxidizing agents that can react with combustible materials to cause fires. Finely divided cobalt dust (not present in this mixture) is flammable. No data are available for the mixture, and its behavior may differ from that of the individual components.

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire: water spray, dry chemical, carbon dioxide, or foam. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen. (These guidelines apply to the mixture; when the components are considered separately, different precautions may apply.)

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): N/A

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Disposal: Refer to Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

Safe Handling Precautions: Wear gloves and chemical safety goggles (Section 8). If contact with this material occurs, wash hands or change clothing as required. Engineering controls should maintain airborne concentrations below TLV (Section 8).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH TLV-TWA: 2 ppm or 5 mg/m³

OSHA TLV-TWA: 2 ppm or 5 mg/m³

UK WEL: 5.2 mg/m³

Cobalt Nitrate (limits for Co compounds):

ACGIH TLV-TWA: 0.02 mg/m³

OSHA TLV-TWA: 0.1 mg/m³

UK WEL: 0.1 mg/m³

Cobalt:

ACGIH TLV-TWA: 0.02 mg/m³

OSHA TLV-TWA: 0.1 mg/m³

UK WEL: 0.1 mg/m³

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Cobalt Nitrate	Cobalt
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Solid red powder	Appearance and Odor: White or gray solid, no odor
Relative Molecular Weight: 63.02	Relative Molecular Weight: 182.96	Relative Molecular Weight: 58.93
Molecular Formula: HNO ₃	Molecular Formula: Co(NO ₃) ₂	Molecular Formula: Co
Specific Gravity: 1.0543 (10%)	Specific Gravity: 2.49	Specific Gravity: 8.92
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Soluble in methanol, ethanol, and acetone	Solvent Solubility: Soluble in dilute nitric acid, hydrochloric acid, and sulfuric acid
Water Solubility: Soluble	Water Solubility: Soluble	Water Solubility: Insoluble
Boiling Point (°C): 86 (187°F)	Boiling Point (°C): N/A (decomposes at melting point)	Boiling Point (°C): 2870 (5198°F)
Melting Point (°C): -42 (-43.6°F)	Melting Point (°C): 105 (221°F)	Melting Point (°C): 1495 (2723°F)
Vapor Pressure (Pa): 946 @20°C	Vapor Pressure (Pa): Negligible	Vapor Pressure (Pa): Negligible
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): N/A	Vapor Density (Air=1): N/A
Critical Solution Temperature: N/A	Critical Solution Temperature: N/A	Critical Solution Temperature: N/A
pH: 1.0 (0.1M solution)	pH: N/A	pH: N/A

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this solution do not exist. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: X Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Incompatible materials.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Cobalt Nitrate: Incompatible with materials that are readily oxidized, including paper, wood, sulfur, aluminum, plastics, tert-butyl hydroperoxide, and ammonium hexacyanoferrate.

Cobalt: Incompatible with strong acids (may release hydrogen gas), strong oxidizers, acetylene, hydrazinium nitrate, ammonium nitrate + heat, 1,3,4,7-tetramethylisindole, and bromine pentafluoride.

Fire/Explosion Information: See Section 5.

Hazardous Decomposition: Thermal decomposition of this material may produce nitrogen oxides and cobalt oxides. Cobalt nitrate decomposes to the oxide at temperatures above 74°C (165°F).

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Nitric Acid:

Human, oral: LD_{Lo} = 430 mg/kg

Rat, oral: LD₅₀ > 90 mg/kg

Rat, inhalation: LC₅₀ (4 hrs) = 130 mg/m³

Cobalt Nitrate:

Rat, oral: LD₅₀ = 434 mg/kg

Rabbit, oral: LD_{Lo} = 250 mg/kg

Cobalt:

Rat, oral: LD₅₀ = 6171 mg/kg, LD_{Lo} = 1500 mg/kg

Rabbit, oral: LD_{Lo} = 750 mg/kg

Target Organ(s): Respiratory tract, thyroid, bone marrow, kidneys, liver, nervous system.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has also been investigated as a possible mutagen. Cobalt nitrate and other cobalt compounds may also cause birth defects.

Health Effects: See Section 3.

12. ECOLOGICAL INFORMATION

Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): LC₅₀ (48 hrs) = 180,000 µg/L

Starfish (*Asterias rubens*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L

Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 µg/L

Cobalt Nitrate: No acute ecotoxicity data found. See Cobalt.

Cobalt:

Eastern narrow-mouthed toad (*Gastrophryne carolinensis*): LC₅₀ (7 days) = 50 µg/L

Goldfish (*Carassius auratus*): LC₅₀ (7 days) = 810 µg/L

Water flea (*Daphnia* sp.): LC₅₀ (48 hrs) = 100,000 µg/L

Environmental Summary: This mixture is to aquatic organisms. Do not release to the environment. The environmental effects of cobalt have not been fully investigated.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture are a RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Nitric Acid Solution, Hazard Class 8, UN2031, Packing Group II

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lb.
Cobalt Nitrate: Not regulated
Cobalt: Not regulated

SARA Title III Section 302: Nitric acid is regulated.

SARA Title III Section 304: Nitric acid is regulated.

SARA Title III Section 313: All three components are regulated.

OSHA Process Safety (29 CFR 1910.119): Nitric acid at higher concentrations ($\geq 94.5\%$) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes
CHRONIC:	Yes
FIRE:	No
REACTIVE:	Yes
SUDDEN RELEASE:	No

STATE REGULATIONS

California Proposition 65: Cobalt is regulated (as metal powder or oxide).

CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)
Cobalt Nitrate: C (oxidizing material)
Cobalt: D2A (very toxic material)

WHMIS Ingredient Disclosure List: All three components are regulated.

CEPA Domestic Substances List (DSL): All three components are regulated.

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)
Cobalt Nitrate: O (Oxidizer); not classified in Annex I of Directive 67/548/EEC
Cobalt: Xn (Harmful)

Risk Phrases (mixture):

R23 (toxic by inhalation)
R25 (toxic if swallowed)
R35 (causes severe burns)
R36/37/38 (irritating to eyes, respiratory system and skin)
R45 (may cause cancer)
R51 (toxic to aquatic organisms)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)
S28 (wash after contact with skin)
S45 (in case of accident or illness, see doctor; show label)
S60 (dispose of this material and its container as hazardous waste)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): All components are listed.

TSCA 12(b), Export Notification: None of the components are listed.

16. OTHER INFORMATION

Sources:

IUCLID Dataset: Cobalt. European Commission, European Chemicals Bureau, 19 February 2000.

IUCLID Dataset: Nitric Acid. European Commission, European Chemicals Bureau, 19 February 2000.

PAN Pesticide Database: Cobalt.

PAN Pesticide Database: Nitric Acid.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, September 2005 edition. DHHS (NIOSH) Publication No. 2005-151.

World Health Organization, International Safety Cards: Cobalt (II) Nitrate.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.